BOOK REVIEWS

A King's Observator

The Correspondence of John Flamsteed, the First Astronomer Royal. Vol. 1, 1666–1682. ERIC G. FORBES, LESLEY MURDIN, and FRANCES WILLMOTH, Eds. Institute of Physics, Philadelphia, 1995. I, 955 pp., illus. $280 or £140.

King Charles II of England usually paid little attention to science, but he was prepared to listen to his favorite mistress, Louise de Keroualle, Duchess of Portsmouth. Louise, through her patronage of one Le Sieur de St. Pierre, played a significant part in one of Charles's most important creations, the Royal Observatory at Greenwich.

St. Pierre claimed that through a simple series of astronomical observations and computations he could determine longitude at sea. In 1674, Charles II appointed a Royal Commission to check if Le Sieur was right. If he was, it would certainly be of exceptional consequence for a maritime nation such as England. A young astronomer, John Flamsteed, shortly thereafter became an assistant to the commission.

Flamsteed concluded that though Le Sieur's proposed method might work in theory, in practice it would be badly inaccurate. Further, even for Flamsteed's preferred technique of "lunar distances," the basic observational data available on the positions of the stars and the motion of the moon were so poor that longitude calculations at sea would be off by hundreds of miles. After speaking with advisers and most likely receiving a copy of Flamsteed's report too, the King proclaimed that the determination of the positions of the stars, sun, moon, and planets "in order to the Discovery of the Longitude" must be executed "in royal fashion." "He certainly did not want," Flamsteed later recalled, "his ship-owners and sailors to be deprived of any help the Heavens could supply, whereby navigation could be made safer." Flamsteed became Charles II's "astronomical observator." A site for an observatory where Flamsteed could secure the desired data was soon selected, construction begun, and the astronomer's career set on a new trajectory.

Although his reputation would later be badly dented by bitter quarrels with Edmond Halley and Isaac Newton, Flamsteed was by any standards a first-rank astronomer. His extensive surviving correspondence also contains material of enormous interest, particularly on the practice of astronomy in the decades around 1700. Some of this correspondence has appeared elsewhere, but the publication of the three projected volumes of *The Correspondence of John Flamsteed* will mark the first time that all of Flamsteed's letters will be available in print. Volume 1 covers the period from 1666 to 1682 and so deals with, among much else, the origins of the Royal Observatory, as well as Flamsteed's well-known dispute with Hevelius on the use of telescopic sights for astronomical measurements. Where a letter was not written in English, an English translation is given in addition to the original. There is a series of biographical notes as well as an excellent index to guide the reader.

The task of copying, collating, and bringing the correspondence into publishable form was begun by the late Eric Forbes, author of a major history of the early Royal Observatory and the leading 20th-century student of Flamsteed's career. It was then completed by Lesley Murdin and Frances Willmoth. The result is a big and beautifully produced volume that not only whets a reader's appetite for volumes 2 and 3, but also stands as a fine tribute to Forbes's scholarship.

Robert W. Smith
National Air and Space Museum, Smithsonian Institution, Washington, DC 20560, USA

The Solar Wind

Interplanetary Magnetohydrodynamics. LEONARD F. BURLAGA. Oxford University Press, New York, 1995. x, 256 pp., illus. $70 or £50. International Series on Astronomy and Astrophysics, 3.

The existence of the solar wind has been accepted for almost 40 years. Although the particle flux from the sun carries negligible mass, it does carry significant angular momentum and represents a third important mode of interaction, after gravity and electromagnetic radiation, between the sun and the planets. Geomagnetic substorms, for example, are often directly attributable to features in the solar wind.

The solar wind is magnetized, the magnetic field being an extension of the magnetic field of the solar corona. Many properties of the wind are understandable only in terms of the magnetic field. Burlaga's *Interplanetary Magnetohydrodynamics* is a detailed description of hydromagnetic structure in the solar wind, primarily as observed by in situ spacecraft probes.

The main strength of the book is the wealth of observational data it provides. Burlaga has made many important contributions to the analysis and interpretation of such data over the years, and he writes with authority. Chapters on interplanetary shocks, solar wind streams, and magnetic clouds include not only the phenomenology of these structures but also attempts to integrate results from laboratory plasma physics and theory of turbulence into their interpretation. Literature through 1994 is cited, and the book represents the observational state of the art up to but not including data sent back by the Ulysses spacecraft, which, as it orbits outside the plane of the ecliptic, is extending our picture of the heliosphere to three dimensions.

As Burlaga's book is fairly specialized, it will be useful primarily to other researchers in interplanetary magnetohydrodynamics. It could have been more useful to a wider audience if its content had been placed in a wider context. An introductory chapter on magnetohydrodynamics, for example, together with a critical assessment of its validity in the solar wind, would have made the book more accessible to students and researchers outside of space physics. Although the important equations are written down and discussed, they are not collected in one place. The best introduction to the basic physics of the solar wind is still A. J. Hundhausen's *Coronal Expansion and Solar Wind* (1972), although some portions of it have been superseded by more recent results.

Similarly, given that much of the structure in the solar wind derives from the structure of the solar corona in space and time, it would have been useful to include more material on solar physics, particularly on topics such as flares, coronal holes, and transient mass ejections, which have signatures in the solar wind. Remote probes of interplanetary turbulence, such as observations of interplanetary scintillation, which complement in situ measurements, would also have enriched the picture.

The book contains a number of typographical errors, the most glaring of which is the persistent replacement of "vortex sheet" by "vortex street." It also uses a fair amount of mathematical terminology, such as the characterization of interplanetary space, not including the sun, as "E3 minus a